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08/183,800	01/21/94	YAMAZAKI	S 0756958

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EXAMINER
CAADAT, R

ART UNIT	PAPER NUMBER
2508	22

DATE MAILED: 05/11/95

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☐ This application has been examined. ☒ Responsive to communication filed on 2-6-95 ☒ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), — days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

- ☐ Notice of References Cited by Examiner, PTO-892.
- ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
- ☐ Notice of Art Cited by Applicant, PTO-1449.
- ☐ Notice of Informal Patent Application, PTO-152.
- ☐ Information on How to Effect Drawing Changes, PTO-1474.
- ☐

Part II SUMMARY OF ACTION

1. ☒ Claims 23-35 are pending in the application.

Of the above, claims _____ are withdrawn from consideration.

2. ☒ Claims 5-14 have been cancelled.

3. ☐ Claims _____ are allowed.

4. ☒ Claims 23-35 are rejected.

5. ☐ Claims _____ are objected to.

6. ☐ Claims _____ are subject to restriction or election requirement.

7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.

8. ☐ Formal drawings are required in response to this Office action.

9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).

10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____, has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).

11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).

12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____.

13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.

14. ☐ Other

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Part III DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claim 32 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In line 1, the term "activation layer" is not clear as to what kind of function may have. Further, in line 5, the term "atoms/cm³" should probably be "atoms/cm³."

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --
(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

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Patentability shall not be negatived by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

4. Claims 23-35 are rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103 as obvious over Nakagawa et al (U.S. Patent No. 4,766,477). The Nakagawa et al reference discloses a thin film transistor with a polycrystalline silicon channel layer 101 formed over an insulating surface of the substrate 100 where a gate electrode 110 via a gate insulating layer 105 contacts the channel layer. The channel layer is later crystallized by heating the substrate leaving oxygen, nitrogen, or carbon concentration at 0.01-5 atomic % levels and average crystal grain size of 200 Å or more. See Nakagawa et al at column 3, lines 16-52 and at column 4, lines 17-44. With regard to claims 33-35, the concentration of oxygen in the prior art includes 0.03 atomic % which is 1.5×10^{19} atoms/cm³. Such concentration is within the range of the claimed concentration of 1×10^{19} atoms/cm³ since the concentration does not change much with 1.5 factor when it is on the order of 10^{19} . With regard to the claim limitations of Raman shift measurements in claims 23-35 no direct reference in the

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specification can be found to indicate a relation to the claimed structure other than a post construction activity for measurement of the grain size as an indication of the crystallinity. The Raman shift numbers are all obtained by changing the amount of oxygen, nitrogen, or carbon which as commonly known in the art result in change of the crystallization of the amorphous silicon and formation of larger grain sizes. The specification refers to similar properties in the paragraph linking pages 8 and 9 by stating that electron mobility is higher for films containing less amorphous components which is a known and inherent property of the recrystallized silicon. Therefore, the prior art structure also meets the Raman shift measurement limitations in claim 23, the ratio of a FWHM in claim 25, and the peak intensity ratio I_a/I_c in claim 27 since all the structural limitations and properties related to and resulting in such measurements are anticipated by the cited reference and indicating the grain size measurements of the prior art device is equivalent to the Raman shift numbers, ratio of a FWHM and peak intensity ratio I_a/I_c for the specified grain size and impurity concentrations. It is known in the art that the shift to 522 cm^{-1} for a single crystal silicon indicates the degree of crystallinity. The grain size is also measured by the half width which is 50 to 500 Å for such impurity levels.

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5. Note that the claims 29-32 are product by process claims and the final structure of the claimed invention do not distinguish over the cited reference. The polycrystal silicon layer may be recrystallized by any method such as laser anneal or simply by any other method of heat treatment. A "product by process" claim is directed to the product per se, no matter how actually made, In re Herein, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessman, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al, 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Double Patenting

6. Claims 23-31 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-16 of U.S. Patent No. 5,313,076. Although the conflicting claims are not identical, they are not

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patentably distinct from each other because the final product that is defined in a product by process claim is what is given weight in examination of such claims. Therefore the device claimed in the instant application is substantially similar to the device of the '076 patent.

7. The obviousness-type double patenting rejection is a judicially established doctrine based upon public policy and is primarily intended to prevent prolongation of the patent term by prohibiting claims in a second patent not patentably distinct from claims in a first patent. *In re Vogel*, 164 USPQ 619 (CCPA 1970). A timely filed terminal disclaimer in compliance with 37 C.F.R. § 1.321(b) would overcome an actual or provisional rejection on this ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 C.F.R. § 1.78(d).

Response to Arguments

8. Applicant's arguments with respect to claims 23-31 have been fully considered but they are not deemed to be persuasive.

a. The overlap of concentration range, however small, as disclosed in the prior art and the instant claims is sufficient to anticipate the claimed invention as described by the present claim language. The crystallization of the polysilicon film as taught by the prior art has resulted in substantially large grains that indicate the high degree of crystallization.

b. The fact that the dopant may be intentionally or unintentionally be added to the silicon have little or no bearing on the final structure. The polysilicon layer that is

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recrystallized and contains a certain concentration of intentional dopants cannot be distinguished from the one with unintentional dopants. The step in which the dopants are introduced in the polysilicon layer may be significant in a process claim where become of no consequence in a device claim.

c. In response to Applicant's argument that the rejection of claims is an "obvious-to-try" rejection, it must be recognized that the cited prior art teaches the kind and the value of the dopant concentration in the polysilicon layer. However, any judgement on obviousness is in a sense necessarily a reconstruction based upon the direct and the suggestive teachings of the prior art. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include all the possible structures that may be made, such a rejection is proper. The values taught in the prior art are identical with values within the claimed range although not limited to the exact claimed range.

d. The major limitations of the claimed invention appear to be a certain level of impurity concentration and crystallinity that result in higher mobility compared with that of the amorphous silicon. The wavenumber corresponding to the Raman shift in claim 23, the ratio of a FWHM in claim 25, and the peak intensity ratio I_a/I_c in claim 27 are all a way of measuring the

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crystallinity of the silicon layer manifested by the larger grain size that increases the carrier mobility. The cited art meets the claimed limitations or their equivalents by indicating the grain size range of more than 200 Å.

e. The overall effect of impurity concentration and the annealing on the grain size also extends to the outcome of the Raman shift measurements. The grain size or crystallinity also indirectly affects the carrier mobility which is clearly taught by the cited art. It is clear from the arguments submitted by Applicants that the Raman shift measurements have no effect on the final structure and do not contribute to the making of the device to the extent that its omission may result in a different structure. It is merely another way of defining crystallinity which is commonly defined by indicating the range for the average grain size. There is apparently no test that directly can measure mobility vs. Raman shift unless a calibrated schedule is used that translates certain numbers to the mobility that is commonly associated with a certain range of grain size. All the measurements are performed after the structure is made and the dopant concentration cannot be changed. There is no indication that while the polysilicon layer is made one of the measurements is simultaneously done to show the Raman shift indicating where to stop a certain process step resulting in an impurity concentration within the claimed range. The measurement is

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performed after all the necessary steps that might impact the impurity concentration have already been completed.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 C.F.R. § 1.136(a).

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS FINAL ACTION IS SET TO EXPIRE THREE MONTHS FROM THE DATE OF THIS ACTION. IN THE EVENT A FIRST RESPONSE IS FILED WITHIN TWO MONTHS OF THE MAILING DATE OF THIS FINAL ACTION AND THE ADVISORY ACTION IS NOT MAILED UNTIL AFTER THE END OF THE THREE-MONTH SHORTENED STATUTORY PERIOD, THEN THE SHORTENED STATUTORY PERIOD WILL EXPIRE ON THE DATE THE ADVISORY ACTION IS MAILED, AND ANY EXTENSION FEE PURSUANT TO 37 C.F.R. § 1.136(a) WILL BE CALCULATED FROM THE MAILING DATE OF THE ADVISORY ACTION. IN NO EVENT WILL THE STATUTORY PERIOD FOR RESPONSE EXPIRE LATER THAN SIX MONTHS FROM THE DATE OF THIS FINAL ACTION.

10. Papers related to this application may be submitted to Group 2500 by facsimile transmission. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989).

The Group 2500 **Fax Center telephone number is (703)305-3594** which is to be used only for faxing papers related to Group 2500 applications.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mahshid Saadat whose telephone number is (703) 308-4915.

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Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Mahshid Saadat

**MAHSHID D. SAADAT
PATENT EXAMINER
GROUP 2500**

mds
May 10, 1995